R10137652

DOCUMENT INFORMATION

Sheet 1 of 1

The following information is required when submitting a document to PDC for issuance.	Correspondence (CCN) No: 070448 Document No: Rev:

Project Information (Check Applicable Box)

☐ Balance of Facilities ☐ HLW Vitrification ☐ Analytical Laboratory ☒ Across all areas

☐ Pretreatment ☐ LAW Vitrification ☐ External Interfaces

Document is applicable to ALARA (as determined by the originator)? ☐ Yes ☒ No

Applicability to ALARA means that the item has the potential to affect doses, contamination levels, or releases to the environment. (See 24590-WTP-GPP-SRAD-002, *Application of ALARA in the Design Process*, sections 4.1 and 4.2 for more information.)

Subject code(s): 4152 (for correspondence only)

ACTION ITEM INFORMATION (for correspondence other than meeting minutes)

Commitments: ☒ Yes ☐ No (if yes, brief description below)

Approve ABAR 24590-WTP-SE-ENS-03-161, Revision 0

Tracked by RITS

Commitment Owed to: BWI Due Date: NOVEMBER 15, 2003

Actionee(s)

R. C. Barr		

Tracked by PADC

Written Response Required: ☒ Yes ☐ No

Owed to: F. Beranek Due Date: November 15, 2003

This correspondence closes action on Correspondence Number

☐ Subcontract Files Copies

☐ PAAA Coordinator MS14-4B

☐ Contains SENSITIVE Information

Additional Departmental Info (to facilitate keyword search)

Internal ☐ DNFSB ☐ ORP ☒ OSR ☒ WDOE ☐ WDOH ☐ Other

Special Instructions for PDC

24590-WTP-RITS-QAIS-03-915

10-23-03 10/23/03

☒ Processed Data Entry ☐ Copied QA ☒ Scanned ☐ Filed

Concurrence Sheet

CCN: 070448

Required Reviewers

Title	Name	Concurrence required (Check appropriately)	Initials	Date
Project Manager	J. P. Betts	☒	[signature]	10/20/03
Deputy Project Manager	A. Beckman	☐		
Operations Manager	S. F. Piccolo	☐		
Engineering Manager	R. J. Tosetti	☐		
Environmental & Nuclear Safety	F. Beranek	☒	[signature]	10/17/03
Construction Manager	T. L. Horst	☐		
Project Controls Manager	D. S. Hardin	☐		
Business Manager	C. E. Rogers	☐		
Acting Contracts Manager	J. M. Armstead	☒	[signature]	10/17/03.
Project QA Manager	G. T. Shell	☐		
HLW Area Project Manager	P. W. Schuetz	☐		
LAW Area Project Manager	W. Clements	☐		
Pretreatment Area Project Manager	R. E. Lawrence	☐		
BOF Area Project Manager	J. Q. Hicks	☐		
Interface Management Manager	T. M. Brown	☐		
Lab Area Project Manager	P. J. Keuhlen	☐		
Process Operations	K. J. Rueter	☐		
Research and Technology	W. L. Tamosaitis	☐		
Commissioning	M. N. Brosee	☐		
Acquisition Services Manager	K. M. Chalmers	☐		
BNI Legal	D. M. Curtis	☐		
Project Manager Special Project 14-3C	H. N. Taylor	☐		

Additional Reviewers

Title	Name	Initials	Date

W. R. Spezialetti — [signature: Tracey Ryan] — 10/16/03

Print/Type Applicable Line Manager's Name — *Signature* — *Date*

T. B. Ryan — [signature: W R Spezialetti] — 10/16/03

Print/Type Originator's Name — *Signature* — *Date*

U.S. Department of Energy
Office of River Protection
Mr. R. J. Schepens
Manager
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

CCN: 070448

OCT 2 3 2003

Dear Mr. Schepens:

CONTRACT NO. DE-AC27-01RV14136 – TRANSMITTAL FOR APPROVAL: AUTHORIZATION BASIS AMENDMENT REQUEST 24590-WTP-SE-ENS-03-161, REVISION 0, "HFP HIGH-HIGH INTERLOCKS SAFETY FUNCTION CHANGE"

Bechtel National, Inc. is submitting Authorization Basis Amendment Request (ABAR) 24590-WTP-SE-ENS-03-161, Revision 0, to the U.S. Department of Energy (DOE), Office of River Protection, and the Safety Regulation Division (OSR) for review and approval. This ABAR proposes to change the safety classification of the high-high liquid level interlock for the Melter Feed Preparation and Melter Feed vessels from Important to Safety (ITS) Safety Design Class to ITS Safety Design Significant (SDS). The high-high liquid level interlocks will remain SDS for overflow protection.

Note that the proposed ABAR changes were made to Revision 0c of the High Level Waste Preliminary Safety Analysis Report (HLW PSAR): however, the ABAR was also included in the updated HLW PSAR Revision 1. To facilitate DOE's review of the ABAR, the ABAR attachments include a redline strikeout of the affected pages for HLW PSAR Revision 1 (Attachment 2) and a crosswalk of the changes between the two versions (Attachment 4).

Approval of this ABAR is requested by November 15, 2003.

An electronic copy of ABAR 24590-WTP-SE-ENS-03-161, Revision 0, is provided for OSR's information and use.

Please contact Mr. Bill Spezialetti at 371-3074 for any questions or comments.

Very truly yours,

J. P. Henschel
Project Director

TR/slr

Attachment: Authorization Basis Amendment Request 24590-WTP-SE-ENS-03-161, Revision 0, plus attachments

cc:

Allen, B. T. w/a	WTP	MS4-B1
Armstead, J. M. w/a	WTP	MS14-3B
Barr, R. C. w/a (1 hard copy and 1 electronic copy)	OSR	H6-60
Beranek, F. w/o	WTP	MS4-A1
Betts, J. P. w/o	WTP	MS14-3C
DOE Correspondence Control w/a	ORP	H6-60
Ensign, K. R. w/o	ORP	H6-60
Eschenberg, J. w/a	ORP	H6-60
Garrett, R. L. w/a	WTP	MS4-B1
Hamel, W. F. w/o	ORP	H6-60
Hanson, A. J. w/o	ORP	H6-60
Henschel, J. P. w/o	WTP	MS14-3C
Klein, D. A. w/o	WTP	MS4-A1
Lorenz, B. D. w/a	WTP	MS5-K
PDC w/a	WTP	MS11-B
Ryan, T. B. w/a	WTP	MS4-B1
Short, J. J. w/o	ORP	H6-60
Spezialetti, W. R. w/o	WTP	MS6-P1
Taylor, W. J. w/a	ORP	H6-60
Tosetti, R. J. w/o	WTP	MS4-A2
Toyooka, M. Y. w/a	WTP	MS5-K
Woolfolk, S. W. w/a	WTP	MS5-K

Attachment to
CCN 070448

Authorization Basis Amendment Request 24590-WTP-SE-ENS-03-161, Revision 0, plus attachments

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161		**Rev. #** 0
Design Document Evaluated:	24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. #** 0
Consists of Parts: ☒ 1 ☒ 2 ☒ 3 ☒ 4		
Title: HFP high-high interlocks safety function change		

Description of design change:

The safety classification of the high-high liquid level interlock is presently SDC to ensure that the headspace of the Melter Feed Preparation vessel (HFP-VSL-00001) and Melter Feed vessel (HFP-VSL-00002) is sufficiently maintained to ensure an acceptable time to the lower flammability limit (LFL) from hydrogen generation. The high-high liquid level interlock for these vessels is no longer credited as a barrier to protect the headspace volume. This does not significantly impact the existing assumptions regarding the time to the LFL for hydrogen generation. The passive vessel overflow line is now credited as an ITS SDC SSC to maintain the required headspace. The high-high liquid level interlock retains the ITS SDS control to prevent the occurrence of vessel overflows.

The addition of the Melter 2 Melter Feed preparation vessel (HFP-VSL-00005) and Melter Feed vessel (HFP-VSL-00006) has been evaluated in safety evaluation 24590-WTP-SE-ENS-02-045 (formerly 24590-WTP-ABAR-ENS-02-013). The changes evaluated in this safety evaluation also apply to the Melter 2 vessels (HFP-VSL-00005 and HFP-VSL-00006).

The changes to the PSAR questions (HLW-PSAR-051, HLW-PSAR-098, HLW-PSAR-189, and HLW-PSAR-190) will be addressed in the implementation of this ABAR.

Reason for design change:

The high-high liquid level interlock for these vessels is currently credited as both SDC to protect the headspace and SDS to prevent overflows. The preliminary design vessel headspace measured from the bottom of the overflow was approximately 285 gallons. The headspace measured from the bottom of the overflow for the current design is approximately 662 gallons. The preliminary design vessel headspace measured from the high-high liquid level interlock was approximately 696 gallons. The headspace volume of the current design (662 gallons) is only an approximate 5% decrease from the headspace volume of the preliminary design (696 gallons), resulting in a negligible affect on the time to the LFL. The passive overflow feature is a more reliable control to prevent reduction in the headspace volume and to maintain assumptions regarding the time to the LFL, than the currently credited active high-high liquid level interlock feature. The attached change to the PSAR also implement sections of OSR PSAR questions/responses HLW-PSAR-051, HLW-PSAR-098, HLW-PSAR-189, and HLW-PSAR-190 associated with high-high liquid level interlocks and overflows. These changes are included to make the PSAR internally consistent.

Complete the following parts as appropriate:

Part 1 Safety Screening

Complete Part 1 for all design changes requiring this form. Refer to Appendix 2 of 24590-WTP-GPP-SREG-002 for guidance. If all Part 1 answers are 'No', or for a 'Yes' answer the design is safe and consistent with the AB, the design change does not require further safety review or an AB change. If this is the case, sign this form after Part 1 and submit to PDC. After each question briefly describe the basis for each answer..

		YES	NO
1.	Does the change modify or delete a standard prescribed in the *Safety Requirements Document Volume II* (SRD)?	☒	☐
	Basis: The change in the safety classification of the high-high liquid level interlock and crediting the vessel overflow line and classifying it as an SDC SSC does not modify or delete a standard in the SRD. The change does not impact the SRD with respect to safety classification of ITS SDC or SDS SSCs. Although these changes do not result in a deletion of standards in the SRD, the changes do result in the deletion of section 4.3.9 of the PSAR, which contains standards that are prescribed in the SRD.		

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161	Rev. # 0
Design Document Evaluated: 24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	Rev. # 0

2.	Does the change alter the location, function, or reliability of an SSC as described in the AB? *This question refers to SSCs described in the LCAR and PSAR, including text descriptions and tables in chapter 2 of the PSAR.*	☒	☐
	Basis: The high-high liquid level interlock is also currently classified as ITS SDS and will remain an ITS SDS function to prevent the occurrence of vessel overflows. Changing the classification of the high-high liquid level interlock from SDC could be viewed as affecting the reliability, however, the functional requirement to alarm and stop flow remains the same. The passive overflow to protect the headspace volume is considered to be more reliable than the high-high liquid level interlock, for maintaining vessel headspace volume.		
3.	Is there a change in classification, new items being classified, or existing items deleted as described in the PSAR?	☒	☐
	Basis: Safety classification of the high-high liquid level interlock for the Melter Feed Preparation vessels and Melter Feed vessels are being changed from ITS SDC to ITS SDS. The high-high liquid level interlocks will remain SDS for overflow protection. With the change in headspace volume (headspace volume measured from the bottom of the overflow changed from 285 gallons to the current 662 gallons), the passive overflow can now be credited to protect the headspace volume of the vessels. The passive overflow also provides more reliable protection of the vessel headspace volume.		
4.	Does the change affect the safety function descriptions in chapter 4 of the PSAR?	☒	☐
	Basis: PSAR sections 4.3.8, 4.3.9, and 4.4.4, and associated Tables 4-1 and 4-2 will be affected. Crediting the passive vessel overflow line to protect the vessel headspace volume is being added to section 4.3.8. Section 4.3.9 is being deleted since the high-high liquid level interlock does not provide the vessel headspace volume protection. Hydrogen producing vessels are being added to section 4.4.4 since the high-high liquid level interlock provides the same function as the vessels that were already mentioned in this section. Tables 4-1 and 4-2 will reflect these changes.		
5.	Does the change create a new hazard or affect the hazard or accident analysis contained in the PSAR?	☒	☐
	Basis: Crediting the vessel overflow to protect the headspace volume of the vessels will result in a negligible increase in the calculated time to the LFL. The times to the LFL in the table in section 3.4.1.7 of the PSAR reflect times to the LFL using the headspace volume measured from the bottom of the overflow. The times to the LFL have increased from 2.3 hours to 6.0 hours for the Melter Feed Preparation vessels and from 2.7 hours to 7.0 hours for the Melter Feed vessels. Section 3.4.1.7.1.2 of the PSAR discusses the use of level instrumentation that prevents the vessel from reaching the LFL during a credible facility blackout. The high-high liquid level interlock will still be classified as SDS for overflow protection. This change does not create a new hazard or adversely affect the PSAR, Chapter 3, regarding hydrogen explosion DBE analysis.		
6.	Does the change affect criticality safety?	☐	☒
	Basis: Changing the classification of the high-high liquid level interlock and crediting the vessel overflow line for headspace volume protection will not affect any credited parameters in the WTP Criticality Safety Evaluation Report (24590-WTP-RPT-NS-01-001, Rev 2).		
7.	Does the change have the ability to affect exposures to radiation (doses), contamination levels, or releases of radioactivity to the environment? If so, has an ADR been completed?	☐	☒

Safety Evaluation No.:	24590-WTP-SE-ENS-03-161	**Rev. #** 0
Design Document Evaluated:	24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. #** 0

	Basis: Crediting the vessel overflow line to protect the headspace volume and changing the classification of the high-high interlocks will not affect doses, contamination levels, or releases of radioactivity to the environment. The high-high liquid level interlock remains an ITS SDS SSC for overflow protection. An ADR is not required for this change.		
8.	Are any other Authorization Basis documents affected by this change?	☒	☐
	Basis: The proposed change in safety classification of the high-high liquid level interlocks does not affect other Authorization Basis documents such as Integrated Safety Management Plan (ISMP), Radiation Protection Program (RPP), Quality Assurance Manual (QAM), and Limited Construction Authorization Request (LCAR). However, the PSAR as amended by BNI's responses to OSR questions HLW-PSAR-051, HLW-PSAR-098, HLW-PSAR-189, and HLW-PSAR-190 are affected by this change. The responses to these questions identified the high-high liquid level interlock with an ITS SDC function to protect the headspace volume and assumptions for hydrogen generation mitigation in the Melter Feed Preparation vessels and Melter Feed vessels.		
9.	As a result of this design change, is an ISM meeting required?	☒	☐
	Basis: An ISM meeting was already conducted to re-evaluate controls necessary to maintain the headspace volume and assumptions regarding the time to the LFL for HFP-VSL-00001 and HFP-VSL-00002 (CCN 049913). The ISM meeting also applies to the Melter 2 Melter Feed Preparation vessel and Melter Feed vessel.		

Further safety review required? ☒ Yes ☐ No

AB change required? ☒ Yes ☐ No

If either answer above is 'Yes', continue with this form. If both answers are 'No', sign here and send Part 1 of this form to PDC.

Safety Evaluation Preparer:	Michael Toyooka *Print/Type Name*	*Signature*	8/25/03 *Date*
Design Document Originator/ Supervisor:	Steven Cross *Print/Type Name*	*Signature*	8/25/03 *Date*

Only required for screenings requiring NO ABCN or ABAR:

H&SA Lead:	N/A *Print/Type Name*	*Signature*	*Date*

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161		**Rev. #** 0
Design Document Evaluated:	24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. #** 0

Part 2 Safety Evaluation (Complete Part 2 for all AB changes)

Complete Part 2 to determine the approval authority for the AB change. Obtain concurrence from H&SA Lead.

REGULATORY		**YES**	**NO**
1.	Based on the answers to the above technical questions and any other analysis, does the change create a new DBE?	☐	☒
	Basis: There is no physical change to the high-high liquid level interlock. Changing the safety classification of the high-high liquid level interlocks and crediting the vessel overflow for headspace volume protection will not create a new DBE. The headspace volume protection that was provided by the high-high liquid level interlock is provided by the vessel overflow line. The high-high liquid level interlock will remain as an ITS SDS control to prevent the occurrence of a vessel overflow. The Concentrate Receipt vessels (HCP-VSL-00001 and HCP-VSL-00002) bound the Melter Feed Preparation vessels and the Melter Feed vessels for liquid spill, overflow, and hydrogen explosion events.		
2.	Based on the answers to the above technical questions and any other analysis, does the change result in more than a minimal ($\geq$10 %) increase in the frequency or consequence of an analyzed DBE as described in the Safety Analysis Report?	☐	☒
	Basis: Changing the safety classification of the high-high liquid level interlock from SDC to SDS and crediting the overflow for headspace volume protection does not result in more than a minimal increase in the consequence of the analyzed DBE for hydrogen explosion. Crediting the overflow to protect the headspace volume results in only an approximate 5% decrease in the headspace volume (696 gallons from the high-high interlock to 662 gallons from the overflow), which is insignificant to the time to the LFL. The discussion of using the level instrumentation to protect the headspace of the vessel from achieving the LFL during a blackout, in PSAR section 3.4.1.7.1.2, no longer applies. With an increased headspace volume (measured from the bottom of the overflow, 285 gallons compared to the current 662 gallons) the overflow protects the vessel headspace volume.		
3.	Based on the answers to the above technical questions and any other analysis, does the change result in more than a minimal decrease in the safety functions of important-to-safety SSCs or change how a Safety Design Class SSC meets its respective safety function?	☒	☐
	Basis: There is no change in the safety function that must be met by the ITS SDC SSCs, that is to protect the headspace volume and assumptions regarding the time to the LFL. The interlock system is reclassified from SDC for vessel headspace volume protection to SDS for overflow protection; however, the vessel overflow line is now credited as ITS SDC to protect the vessel headspace volume. The vessel overflow line is a passive feature and is considered more reliable than the active feature of the high-high liquid level interlock. The functional requirement of the high-high liquid level interlock to alarm and stop feed has not changed, but the safety function that the high-high liquid level interlock provides is being eliminated as an SDC control for the hydrogen explosion DBE.		
4.	Does the change result in a noncompliance with applicable laws and regulations (i.e., 10 CFR 820, 830, and 835) or nonconformance to top-level safety standards (i.e., DOE/RL-96-0006)?	☐	☒
	Basis: Changing the classification of the high-high liquid level interlock (SDC to SDS) and crediting the overflow for headspace volume protection is still compliant with the requirements of 10 CFR 830 with respect to classification of Safety components. The		

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161	Rev. # 0
Design Document Evaluated: 24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. # 0**

	change does not impact other laws and regulations. The change is in conformance with the top-level safety standards of DOE/RL-96-0006 in that it still provides adequate defense in depth.		
5.	Does the change fail to provide adequate safety?	☐	☒
	Basis: The change provides adequate safety. Crediting the passive vessel overflow line feature to protect the headspace volume is considered a more reliable control than the active high-high liquid level interlock feature that currently is credited to protect the vessel headspace volume. The high-high liquid level interlocks remain credited as an SDS preventative barrier for vessel overflows. The time to the LFL for these vessels will increase from what is currently stated in PSAR section 3.4.1.7 (table uses headspace volumes calculated from the bottom of the overflow). The times to the LFL has increased from 2.3 hours to 6.0 hours for the Melter Feed Preparation vessels and from 2.7 hours to 7.0 hours for the Melter Feed vessels. Crediting the overflow for headspace protection will ensure that the headspace volume and assumptions regarding the time to the LFL is maintained. In PSAR section 3.4.1.7.1.2, the statement "The level instruments thus protect against a credible facility blackout that is longer than the overflow-level time to LFL," was intended for the Melter Feed Preparation and Melter Feed vessels, as discussed in PSAR questions/responses HLW-PSAR-051, HLW-PSAR-098, and HLW-PSAR-190. The statement in PSAR section 3.4.1.7.1.2 no longer applies since the vessel headspace volume (measured from the overflow) has increased from the preliminary design that was used to evaluate this event (from 285 gallons to 662 gallons). Crediting the overflow to protect the vessel headspace and changing the high-high liquid level interlock from SDC to SDS have been evaluated against the ORA and Seismic PRA. The vessel overflow is more reliable than the high-high liquid level interlock, since the overflow is a passive feature and the high-high liquid level interlock is an active feature. The changes do not present any significant impacts to the ORA nor do they impact the Seismic PRA.		
6.	Does the change result in nonconformance to the contract requirements associated with the authorization basis document(s) affected by the change? See Contract Standard 7(e)(2).	☐	☒
	Basis: The proposed changes to the safety classification for the high-high liquid level interlocks and crediting the overflow for vessel headspace volume protection for the Melter Feed Preparation vessels and Melter Feed vessels are not contained in the contract requirements associated with the AB document affected by these changes.		
7.	Does the change result in an inconsistency with other commitments and descriptions contained in portions of the authorization basis or an authorization agreement not being revised?	☒	☐
	Basis: Responses to OSR PSAR questions HLW-PSAR-051, 098, 189, and 190 refer to the high-high liquid level interlocks for vessels HFP-VSL-00001 and HFP-VSL-00002 as being credited to protect the headspace and to prevent overflows. The sections of the responses associated with the high-high liquid level interlocks and vessel overflows under these revised assumptions are incorporated into the attached corrected PSAR sections.		

Safety Evaluation For Design

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161		Rev. # 0
Design Document Evaluated:	24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. # 0**

*If all Part 2 questions are answered 'No', a BNI-approved AB change (ABCN) is permitted. Complete Part 3 of this form and send it to the E&NS AB Coordinator. If any Part 2 question is answered 'Yes', a DOE-approved AB change (ABAR) is required. Complete Parts 3 **AND** 4 of this form and send to the E&NS AB coordinator.*

BNI-approved AB change? ☐ Yes ☒ No

DOE-approved AB change? ☒ Yes ☐ No

Concurrence:	Initial	Date
H&SA Lead:	[signature]	9/4/03

RLG 9/5/03

Safety Evaluation For Design

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161	Rev. # 0
Design Document Evaluated: 24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	Rev. # 0

Part 3 BNI-Approved AB Change

List affected AB documents, obtain necessary concurrences and approval, and send this form to the E&NS AB coordinator. If an SRD change is involved, obtain PMT and PSC reviews.

Affected Authorization Basis Documents:

Title	Document Number	Rev	Section
Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information	24590-WTP-PSAR-ESH-01-002-04	0c	Sections 3.4.1.7, 3.4.1.7.1.2, 4.3.8, 4.3.9, 4.4.4, 5.5.7, and 5.5.9 Tables 4-1, 4-2, and 5-1

Concurrences: (check affected departments)

Review Required?	Organization	Print / Type Name	Signature	Date
☒	Safety Evaluation Preparer	Michael Toyooka	[signature]	8/25/03
☒	AB Document Custodian	Don Foss	[signature]	9/5/03
☐	Quality Assurance			
☒	Engineering mr 9/10/03	Steve Anderson ~~Dilip Patel~~	S E Anderson	9/10/05
☒	Affected Area Project Manager	Phil Schuetz	[signature]	9/14/03
☒	Operations	Cindy Beaumier	[signature]	9/10/03
☐	Construction			

Other Affected Organizations	Print / Type Name	Signature	Date
N/A if None	N/A		

BNI-Approved AB Change Approved:

E&NS Manager: Fred Beranek (*Print/Type Name*) [signature] (*Signature*) 10/17/03 (*Date*)

Safety Evaluation No.: 24590-WTP-SE-ENS-03-161	Rev. # 0
Design Document Evaluated: 24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	Rev. # 0

Part 4 DOE-Approved AB change

Decision to deviate: ☐ Yes ☒ No

If 'Yes', DTD No.: ____________ Rev: ________

List the AB change implementing activities and the projected completion dates:

Activity	**Date**
Inform DOE that AB has been revised and formally transmit electronic version	30 days or less after DOE approval
Distribute revised controlled copy pages / update WTP Electronic Library	30 days after DOE approval
Revise the following implementing documents:	

Documents	**Describe extent of revisions**	**Date**
1		
2		
3		
4		

Describe other activities	**Date**
1 N/A	
2	
3	
4	

Concurrence/confirmation of AB change if SRD is changed:

PMT Chair: N/A ____________ ____________

Print/Type Name *Signature* *Date*

PSC Chair: N/A ____________ ____________

Print/Type Name *Signature* *Date*

Certification of Continued SRD Adequacy:

If this ABAR involves the deletion or modification of a safety criterion, code, or standard previously identified or established in the SRD, Project Director certification is required. The Project Director's signature certifies that the revised SRD continues to identify a set of standards that provides adequate safety, complies with WTP applicable laws and regulations, and conforms with top-level safety standards and principles. This certification is based on adherence to the DOE/RL-96-0004 standards identification process and successful completion of review and confirmation by the PSC.

WTP Project Director: N/A ____________ ____________

Print/Type Name *Signature* *Date*

Safety Evaluation No.:	24590-WTP-SE-ENS-03-161	**Rev. # 0**
Design Document Evaluated:	24590-HLW-M6-HFP-00001 24590-HLW-M6-HFP-00002 24590-HLW-M6-HFP-20001 24590-HLW-M6-HFP-20002	**Rev. # 0**

Attachments: (page changes for all ABARs)

Attachment 1 - Proposed changes to the PSAR (24590-WTP-PSAR-ESH-01-002-04, Rev. 0c) (16 pages)

Attachment 2 - Proposed changes to the PSAR (24590-WTP-PSAR-ESH-01-002-04, Rev. 1) (15 pages)

Attachment 3 - CCN 059856 (6 pages)

Attachment 4 - Crosswalk of Affected Sections from Rev. 0c to Rev. 1 of the HLW PSAR (2 pages)

24590-WTP-SE-ENS-03-161 Rev 0

Attachment 1

Proposed Changes to the Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information (24590-WTP-PSAR-ESH-01-002-04, Rev. 0c)

Document Part	Title	Affected Pages
Section 3	Hazard and Accident Analyses	3-85 and 3-89
Section 4	Important to Safety Structures, Systems, and Components	4-19, 4-21, 4-22, 4-40, 4-41, 4-63, and 4-66
Section 5	Derivation of Technical Safety Requirements	5-13, through 5-16, 5-23, and 5-29

Target Frequency

For this waste drum/cask DBE, the estimated unmitigated consequences to the facility worker and co-located worker are SL-1, which should have a frequency/failure probability below 1.0E-06/yr (SRD, Volume II). The drum cask will be designed to survive the analyzed drop; therefore, a release is considered not credible. Likewise, one frequency for dropping an overpack from the dock, 9.6E-9/yr, is not credible.

3.4.1.6.4.7 Summary of ITS SSCs and Candidate Controls TSRs

Tables 4-1, 4-2, and 5-1 summarize the ITS SSCs and candidate TSRs, respectively, identified to prevent or mitigate the drop of a drum cask. For each of the ITS SSCs and the candidate TSRs the hazard prevented or mitigated is identified, and the safety function is provided.

3.4.1.7 Hydrogen Explosion

Three hydrogen deflagration or detonation events in HLW vessels have been identified as DBEs for further analysis. The first is the loss of purge air due to a loss of off-site power. Radiolytic hydrogen generation builds up a flammable concentration of hydrogen in the vessel vapor space, leading to a possible deflagration or detonation. The second is loss of mechanical mixing in the feed vessels HFP-VSL-00001 or HFP-VSL-00002. The third is loss of the pulse jet mixers mixing in the concentrate receipt vessels HCP-VSL-00001 or HCP-VSL-00002. Loss of mixing in these events leads to hydrogen being trapped and stored in the solids. The hydrogen is then assumed to release instantaneously to the head space of the vessel when mixing is restored to the vessel.

The analyses in *Design Basis Event – HLW Process Vessel Hydrogen Deflagration* (24590-HLW-ZOC-H0IT-00001) apply to the bounding HLW vessels containing the most radionuclides and/or having the potential to reach LFL in the shortest time. Since the time to reach LFL in a vessel depends on the radionuclide content of the vessel, this criterion for selecting the bounding vessels is not mutually exclusive. The two vessels selected for consequence analysis are the concentrate feed vessels (HCP-VSL-00001 and HCP-VSL-00002), which have the highest radionuclide content and the largest headspace. The frequency of the event was based on the melter receipt vessels HFP-VSL-00001 and HFP-VSL-00002 that exhibit the shortest time to reach LFL (the plant wash and drains vessel RLD-VSL-00008 is not considered, as this vessel is unlikely to contain significant waste). This analysis is in *Revised Severity Level Calculations for the HLW Facility,* (24590-HLW-Z0C-W14T-00013) and 24590-HLW-ZOC-H0IT-00001.

Vessel Designator	**Time (hr)** 1 %	**Time (hr)** 4 %	**Time (hr)** Δt
HFP-VSL-00001	~~0.8~~2.0	~~3.1~~7.9	~~2.3~~6.0
HFP-VSL-00002	~~0.9~~2.3	~~3.6~~9.2	~~2.7~~7.0
RLD-VSL-00008	1.1	4.5	3.4
HCP-VSL-00001	1.4	5.6	4.2
HCP-VSL-00002	1.4	5.6	4.2

Since a deflagration is expected to damage downstream filtration devices, any materials entrained by the hot gases that follow the burn can be expected to be carried into the environment. Therefore, each of the selected control strategies is preventive. The probability of ignition is assumed to be 1.0 at the LFL, so the frequency of the accident scenario equates to the frequency with which the vessel reaches its LFL. This could occur as the result of loss of offsite power followed by failure of the onsite power system or failure of the ITS air compressor system, and the inability of Operations to recover site power feeds or the on-site power or ITS air systems.

The frequency of an accident sequence involving achievement of LFL in the headspace of a process vessel takes on the form:

Frequency of LFL = (frequency of loss of purge)(probability purge loss exists for t hrs [time to reach LFL] based on vessel level)(probability purge is not recovered within time, t). An event tree was developed to show the combinations of levels, times, and recovery factors for loss of purge and agitation events (*WTP Probabilistic Risk Analysis* [PRA], 24590-WTP-U7C-50-00001). It is discussed below.

As the waste level in the vessel increases, there is more hydrogen-producing material and less head space. As a result, it takes less time to reach LFL when the level is higher. The time to reach LFL in the vessel head space is calculated at four waste levels (in order of decreasing time to LFL), from normal (assumed to be maintained using operational controls), to high (limited by a SIL-1 level alarm), to high-high level, (protected by a SIL-2 alarm and trip), and finally to overflow point (set by design). The probability of being in any of the four states is evaluated based on the failure probability of the operational and instrument controls that keep the waste level below the overflow. Because the time to LFL is based on a starting concentration of 1 % of LFL, the normal purge rate of 100 times the maximum hydrogen generation rate is monitored to protect this initial condition.

The duration of loss of systems is evaluated based on the time available for these specific waste levels. As a result, the probability of having an initiator (loss of site power, process air, or normal purge equipment), the probability of being at a specific waste level, and the likelihood of recovering failed systems or alternate equipment given the time to LFL, combine to produce the frequency of reaching LFL. Because it is less probable that the vessel waste level will be above normal process level than at normal level, the shorter time to recover offsite power or other components (such as EDGs in a facility blackout) when at the higher levels is offset. ~~The level instruments thus protect against a credible facility blackout that is longer than the overflow level time to LFL.~~

Because power is required to provide purge air during loss of offsite power, three EDGs are required. Common cause failure of three similar diesel generators drives the probability of facility blackout sufficiently low to meet reliability requirements. Two diesel generators are not sufficiently reliable. Thus, the power to each ITS air compressor is fed from one of the EDGs, with automatic switchover to the third if power is lost from one of the first two (*WTP Facility Blackout Calculation*, 24590-WTP-U7C-50-00003).

The B/D waste stream leads to the shortest times to LFL. The vessel that presents the greatest challenge is the feed preparation vessel. While it has slightly greater times to LFL than the plant wash and drains vessel, it is operated full for most of the time that the facility is operating. The plant wash and drains vessel is not expected to be full with significant solids very often, if at all, especially when a number of other vessels overflow to this vessel.

4.3.8.2 System Description

The purge and mixing features of the hydrogen mitigation purge system are designed to maintain hydrogen concentrations in the vessel headspace below 1 % by volume during normal operations, and less than 4 % by volume during accident conditions.

4.3.8.3 Functional Requirements

The functional requirements for the hydrogen mitigation purge system are to maintain the hydrogen concentrations in the vessel headspaces to less than 4 % by volume hydrogen for all accident conditions such as loss of power or air. The SDC portions of the system will operate after NPH events; therefore they are SC-I. SDC SSCs will meet QL-1 requirements.

Air supply system

To meet the functional requirements in the headspace, air will be supplied for the continuous headspace purge and to the air operated pulse jet mixers and sparge rings for solids mixing. To ensure that the purge and mixing requirements are met, redundant emergency diesel generators and air compressors will be provided in addition to a UPS backed control system. To ensure sufficient air is supplied for the continuous headspace purge, the sparge rings, and the SDC air operated pulse jet mixing system, when pressure instrumentation senses low pressure in the SDC air supply system, a signal is sent to the Pretreatment SDC air supply system to attempt to start a backup air compressor.

Headspace purge

To meet the functional requirements in the vessel headspace, a continuous headspace purge is required. The minimum recommended flow rate is 100 times the maximum hydrogen generation rate. The normal exhaust from the headspace purge will flow through the offgas treatment system. A secondary flow path is through the vessel overflow line. The vessel overflow line also provides protection of the headspace and the assumptions regarding the time to the LFL.

Solids mixing

To meet the functional requirements in the headspace, waste agitation is required to release trapped hydrogen gases. The mixing systems include the following.

Loss of air to the normal pulse jet mixer air supply, or loss of control to the pulse jet mixing system starts an SDC air operated pulse jet mixer system in the concentrate receipt vessels and the plant wash and drain vessel. At least half of the pulse jets for each vessel will operate for 15 min with a periodicity of operating periods equal to or less than the time required for the vessel headspace to reach 4 % by volume hydrogen, without the headspace purge assuming all of the trapped hydrogen is released. The SDC pulse jet mixer system uses an SDC air supply to provide air to the pulse jet mixing system. The SDC pulse jet mixer system includes valves and controllers independent from the normal pulse jet mixing systems. The SDC pulse jet mixing system controllers and valves require SDC power to maintain operation.

Mechanical agitators will normally be operating in the feed preparation vessel and the melter feed vessel. Emergency mechanical agitation will be provided by either the mechanical agitators, transfer recirculation pumps, or air sparge rings.

The instrument and control systems sequence the air supply to specific vessels and monitor headspace purge airflow supply. The safety controls and monitoring systems necessary to ensure pulse jet mixer sequencing and headspace purge airflow are discussed in section 5.5.4

The transfer and recirculating pumps provide redundant mechanical mixing capabilities. The surveillance requirements required to test and verify the transfer and recirculating pumps performance are discussed in section 5.5.4.

The mechanical agitators provide agitation of the waste. The surveillance requirements required to test and verify mechanical agitator performance are discussed in section 5.5.4.

The following requirements are considered design features, and are discussed in section 5.6.2.

- The pulse jet mixers and air sparge rings provide waste mixing.
- The air supply lines and isolation and check valve bodies to provide a continuous air supply path.
- The overflow line to provide secondary path for air purge and protection of the headspace volume.

4.3.9 ~~High-High Liquid Level Control Loop (H_2 mitigation)~~Deleted

~~The high-high liquid level interlock is required to maintain the analyzed liquid levels in the concentrate receipt vessels, melter feed preparation vessel, melter feed vessel, and the plant wash and drains vessel to control headspace volumes and the assumptions regarding the times to LFL.~~

~~4.3.9.1Credited Safety Function~~

~~The safety function of the high-high liquid level interlock is to maintain the level of liquid in the vessels of concern such that the assumptions regarding the minimum time to LFL are protected.~~

~~4.3.9.1System Description~~

~~The high-high liquid level interlock is required to maintain the analyzed liquid levels in the concentrate receipt vessels, feed preparation vessel, melter feed vessel, and the plant wash and drains vessel to control headspace volumes and the assumptions regarding the times to LFL. The time to LFL is required to establish system reliability requirements and initiation of hydrogen purge/solids mixing strategies. The high-high liquid level on the concentrate receipt vessels is interlocked to the liquid transfer control systems in the pretreatment facility. The interlock on feed preparation vessel, melter feed vessel, and the plant wash and drains vessel will stop flow into each respective vessel on detection of a high-high liquid level.~~

~~4.3.9.3Functional Requirements~~

~~The high-high liquid level control loop is designed to control accident conditions resulting in loss of headspace. The interlocks will perform their intended safety function (maintain vessel liquid levels in the H_2 producing vessels of concern). The liquid level interlocks will detect high-high liquid levels in their vessels and initiate source liquid transfer control systems (stop transfers to the vessel). However, transfers out of the HLW facility are still permitted.~~

~~The interlocks will be SC-I and designed to meet SRD Safety Criteria 4.1-2, 4.1-5, 4.2-1, 4.3-4, 4.3-5, 4.4-2, 4.4-4, 4.4-5, 4.4-6, 4.4-9, 4.4-10, and 4.4-11. SDC SSCs will meet QL-1 requirements.~~

~~4.3.9.4Standards~~

~~The high-high liquid level loop will be designed and constructed in accordance with the following:~~

~~The high-high liquid level interlock will be designed and constructed in accordance with ISA-S84.01, IEEE-338, IEEE-344, IEEE-379, IEEE-384, and IEEE-1023.~~

~~4.3.9.5System Evaluation~~

~~The high-high liquid level instrument control loop will control high-high liquid levels in the vessel and initiate liquid transfer controls (stop transfers to the vessel). or for the plant wash and drains vessel, and also stop transfers to other vessels in the facility that have an overflow path to the plant wash and drains vessel. ISA S84.01 is applied for all automatically executed safety instrumented systems to provide the necessary guidance to ensure the required reliability of those systems (~5.0 × 10^-3/yr). A tailored version of IEEE-338 supplements ISA S84.01 in designing safety instrumented systems so they can be tested to prove that the adequately perform their required safety functions. A tailored version of IEEE 344 is applied to those safety instrumented systems required to function during and (or) after a seismic event. A tailored version of IEEE 379 is applied to safety instrumented systems to supplement ISA-S84.01 in design considerations ensuring that the single failure criterion of those systems is met. A tailored version of IEEE 384 is applied to safety instrumented systems to supplement ISA-S84.01 in design considerations for independence of multiple-channel safety systems. Finally, a tailored version of IEEE 1023 is applied to all safety functions requiring indication and/or alarm at a safety qualified operator interface.~~

~~4.3.9.1Controls (TSRs)~~

~~Each high-high liquid level control loop will control the volume of the headspace. Therefore, a specific TSR will be developed for each loop specifying surveillance and testing requirements. The interlocks necessary to ensure adequate headspace are discussed in section 5.5.7.~~

4.3.10 Pulse Ventilation Treatment System

The pulse ventilation treatment system contains fans, HEPA filters, and electric preheaters, and ducting required to discharge the air emissions from fluidics equipment. It is an integral part of the solids mixing air system (section 4.3.7 and 4.3.8).

4.3.10.1 Credited Safety Function

The safety function of the pulse ventilation treatment system is to maintain airflow from the pulse jet mixers as part of solids mixing. The ductwork and fans provide a flow path for the fluidics equipment. The HEPA filters will not clog or block the flow path. The HEPA filters are SDS to support normal operations. The preheaters are SDS to help maintain the flow path through the HEPA filters by preventing the filters from becoming saturated with moisture.

Melter Feed Interlock on High Pressure

The safety function of the melter feed shut off interlock is to limit the material at risk during an offgas event.

High-High Vessel Level Interlock

The SBS, ~~high-high liquid level and~~ acidic waste vessel, melter feed preparation vessel, melter feed vessel, concentrate receipt vessels, and plant wash and drains vessel high-high liquid level interlocks prevent overflows of the vessels. The SBS and SBS condensate receiver vessel high-high level also prevents a liquid level that could potentially block the offgas system.

4.4.4.2 System Description

The interlocks are designed to control or mitigate accident conditions resulting in glass spills, overflows, or failure of the offgas system.

High-High Canister Level Interlock

The level detection for the canister sends a signal to the programmable protection system. When the level detection system for the canister exceeds the high-high level setpoint, the ITS control system shuts off air to the safety valves to stop air to the melter air lift, which stops the pour.

Melter Feed Interlock on High Pressure

The melter feed/plenum pressure interlocks stop feed to the melter in the event of loss of melter plenum vacuum or pressurization.

High-High Vessel Level Interlock

SBS and SBS condensate receiver vessel high-high liquid level interlock automatically trips feed into the SBS vessels at the high-high liquid level setpoint.

The acidic waste vessel high-high liquid level interlock automatically trips feed into the acidic waste vessel at the high-high liquid level setpoint.

The melter feed preparation vessels high-high liquid level interlocks automatically trips feed into the affected melter feed preparation vessel at the high-high liquid level setpoint.

The melter feed vessels high-high liquid level interlocks automatically trips feed into the affected melter feed vessel at the high-high liquid level setpoint.

The concentrate receipt vessels high-high liquid level interlocks automatically trips feed into the affected concentrate vessel at the high-high liquid level setpoint. The high-high liquid level on the concentrate receipt vessels are interlocked to the liquid transfer control systems in the pretreatment facility.

The plant wash and drains vessel high-high liquid level interlock automatically trips feed into the plant wash and drains vessel at the high-high liquid level setpoint.

4.4.4.3 Functional Requirements

The interlocks will meet the reliability requirements of 5.0×10^{-3}/yr. The DBE analysis, the interlocks will be SC-III and designed to meet SRD Safety Criteria 4.1-2, 4.1-3, 4.1-5, 4.2-1, 4.3-4, 4.3-5, 4.4-2, 4.4-4, 4.4-5, 4.4-6, 4.4-9, 4.4-10, and 4.4-11. SDS SSCs will meet QL-2 requirements.

High-High Canister Level Interlock

The canister level measurement instrumentation will be able to detect a high-high level of glass in the canister and provide an actuating signal to the associated interlock that follows. The melter airlift process will stop feed to the melter on receiving an actuation signal from the high-high level signal from the canister level measurement instrumentation.

Melter Feed Interlock on High Pressure

The melter plenum pressure instrumentation will be able to detect rises in pressure in the melter plenum and provide an actuating signal to the associated interlocks that follow when the melter plenum pressure reaches a predetermined value. The melter plenum pressure interlocks will stop feed to the melter on receiving an actuation signal from the melter plenum pressure instrumentation.

High-High Vessel Level Interlock

The high-high vessel liquid level instrumentation will be able to detect a high-high level of liquid in the vessel and provide an actuating signal to the transfer pumps or valves that are providing feed. The transfer devices or valves will stop inflows to the destination vessel on receiving an actuation signal from the high-high level instrumentation. For the SBS and SBS condensate receiver vessel, the high-high interlock also shuts down the melter feed.

4.4.4.4 Standards

The following interlocks will be designed and constructed in accordance with ISA S84.01, IEEE 338, and IEEE 1023:

- High-high canister level interlock
- Melter feed interlock on high pressure
- SBS, SBS condensate receiver vessel, ~~and~~ acidic waste vessel, melter feed preparation vessels, melter feed vessels, concentrate receipt vessels, and plant wash and drains vessel high-high level interlock

4.4.4.5 System Evaluation

The interlocks will reliably stop process operations until the required safety condition has been met. ISA S84.01 is applied for all automatically executed safety instrumented systems to provide the necessary guidance to ensure the required reliability of those systems. A tailored version of IEEE 338 is applied to supplement ISA S84.01 in designing safety instrumented systems so they can be tested to prove that the adequately perform their required safety functions. Finally, a tailored version of IEEE 1023 is applied to all safety functions requiring indication and/or alarm at a safety qualified operator interface.

Table 4-1 Important to Safety: Description and Basis for Safety Design Class Structures, Systems, and Components

SDC System (Major Components)	Safety Function	Functional Requirements/ Standards (Chapter 4)	Basis for ITS Designation (Chapter 3)
Concentrate Receipt, Feed Preparation, Melter Feed, and Plant Wash and Drains Vessels	Provide primary confinement of liquids	Section 4.3.7	Section 3.4.1.1
Select Air Supply Piping, Controls, and Valving for H_2 Mitigation	Provide H_2 purge and tank mixing	Section 4.3.8	Section 3.4.1.7
Air Compressors for H_2 Mitigation (in Pretreatment facility)	Provide H_2 purge and tank mixing	Section 4.3.8	Section 3.4.1.7
Mechanical Agitators for H_2 Mitigation	Provide tank mixing to prevent accumulation of H_2	Section 4.3.8	Section 3.4.1.7
Transfer Recirculation Pumps for H_2 Mitigation	Provide tank mixing to prevent accumulation of H_2	Section 4.3.8	Section 3.4.1.7
Overflow Lines in Concentrate Receipt, Melter Feed Preparation, Melter Feed, and Plant Wash and Drains Vessels	Provide an alternative passive pathway for H_2 ventilation and for H_2 mitigation to ensure headspace protection and assumptions of times to the LFL	Section 4.3.8	Section 3.4.1.7, 3.4.10
~~High-high Liquid Level Detection Interlock in Concentrate Receipt, Melter Feed Preparation, Melter Feed, and Plant Wash and Drains Vessels~~	~~For H_2 mitigation – ensures headspace and assumptions of time to LFL~~	~~Section 4.3.9~~	~~Section 3.4.1.2~~
Pulse Ventilation Treatment System Exhaust Fans and Safety Controls to Transfer to Standby Fan	The fans provide a flow path for the fluidics equipment	Section 4.3.10	Section 3.4.1.7
Pulse Ventilation Treatment System Ductwork	The ductwork provides a flow path for the fluidics equipment	Section 4.3.10	Section 3.4.1.7
Gamma Monitors Interlocked with Shield Doors	Prevents entry into a high radiation area	Section 4.3.11	Sections 3.4.1.10 and 3.4.1.11

Table 4-2 Important to Safety: Description and Basis for Safety Design Significant Structures, Systems, and Components

SDS System (Major components)	Safety Function	Functional Requirements/ Standards (Chapter 4)	Basis for ITS Designation (Chapter 3)
High-High Liquid Level Detection Interlock in SBS, SBS Condensate Receiver Vessel, ~~and~~ Acidic Waste Vessel, Melter Feed Preparation Vessels, Melter Feed Vessels, Concentrate Receipt Vessels, and Plant Wash and Drains	To prevent blockage of the offgas system ~~(H_2 mitigation)~~ and/or overflows	Section 4.4.4	Sections 3.4.1.2 and 3.4.1.8
Radiation Monitor in Cooling Water Loop	Detect radiation in non-active process lines and signal interlock	Section 4.4.5	Section 3.4.1.10
Interlock with Radiation Monitoring in Cooling Water Loop Isolation Valves.	On detection of radiation, automatically stop flow and engage isolation valves	Section 4.4.5	Section 3.4.1.10
Acidic Waste, SBS, SBS Condensate Vessels	Provide primary confinement of liquids	Section 4.4.6	Section 3.4.1.1 and 3.4.2.1
Process Piping	Provide primary confinement of liquids	Section 4.4.7	Sections 3.4.1.1, 3.4.1.3, 3.4.1.10, 3.4.1.12, and 3.4.2.1
Minimum barometric head of 34 ft associated with service lines into active vessels (e.g. jet pump piping)	Provide sufficient barometric head to prevent blowback or suckback of contamination to potentially occupied areas	Section 4.4.7	Sections 3.4.1.10
Melter Shell	Shell provides containment of bulk glass	Section 4.4.8	Section 3.4.1.4 and 3.4.2.1
Cranes and Lifting Devices (load path components) • Canister and Cask Handling Cranes • Secondary Waste Container and Cask Cranes	Load path components designed to minimize the occurrence of dropped loads	Section 4.4.9 and 4.4.10	Sections 3.4.1.5, 3.4.1.6, 3.4.1.9, and 3.4.2.1

These controls apply to the HLW facility in all modes.

Derivation Criteria: This control was selected to prevent unacceptable radiological exposures to facility workers.

5.5.7 ~~Limiting Conditions for Operation – High-High Liquid-Level Interlock (Process Interlocks) Operability~~Deleted

~~**Purpose:** This control, based on section 3.4.1.7, Hydrogen Explosion Accident, ensures the operability of the high-high liquid level interlocks. The interlocks protect high liquid levels and loss of headspace volume in the following vessels:~~

- ~~Concentrate feed (two vessels)~~
- ~~Melter feed~~
- ~~Melter feed preparation~~
- ~~Plant wash and drains~~

~~This control maintains adequate headspace in the vessels to maintain a purge flow and to prevent reaching LFL. When the melter feed preparation and melter feed vessels reach the high-high level, an interlock with the source liquid transfer control system terminates transfers into the vessels. When the two concentrate feed vessels and the plant wash and drains vessels reach the high-high level, an interlock stops flow into the vessels from all sending systems. Without controls, loss of headspace volumes will reduce the time to reach LFL in the vessel headspaces. This could challenge the assumptions in the accident analysis with respect to system reliability (reestablishing the purge system) and the hydrogen purge/solids mixing strategies. This control will ensure that time to restore headspace purge is maintained.~~

~~The TSR operability requirements for the high-high liquid level interlock include the following elements.~~

- ~~The level detection instrumentation in the two concentrate feed vessels, the melter feed vessel, the melter feed preparation vessel, and the plant wash and drains vessel shall be operable.~~
- ~~All in-feed shutdown valves shall be operable (specific valves will be identified during detailed design).~~
- ~~The high-high level detection interlocks in the two concentrate feed vessels, the melter feed vessel, the melter feed preparation vessel, and the plant wash and drains vessel (including necessary shutoff valves) shall be operable.~~
- ~~The high-high level detection interlocks shall be provided with HLW SDC uninterruptible power supply (UPS).~~

~~If these controls fail, the levels in the vessels could go above those analyzed in the accident analysis. An increase in level reduces the time to reach the LFL in the vessels, thus reducing the time allowed to restore purge flow in the vessel. Purge flow is required to prevent a hydrogen deflagration/detonation.~~

- ~~Periodic functional tests of the high-high level interlock for each vessel (including necessary shutoff valves)~~

- ~~Periodic instrument loop calibrations of the high-high level monitoring instrumentation~~
- ~~Periodic verification that the level detection instruments are operable~~

~~Operability requirements and surveillances on the HLW SDC UPS power are required, and are covered in a separate LCO.~~

~~These controls apply to the HLW facility in all modes.~~

~~**Derivation Criteria:** This control was selected to prevent hydrogen explosions/deflagrations within the affected vessel(s).~~

5.5.8 Limiting Conditions for Operation – Mechanical (shield door and gamma shield door) Interlock Operability

Purpose: This control, based on section 3.4.1.11, Direct Radiation Accident, ensures the mechanical interlocks' operability. The interlocks limit personnel access and prevent unacceptable exposures to high radiation sources. Without controls, facility workers could be exposed to high radiation, resulting in exposures to the facility worker above the RES. Several types of mechanical interlocks are credited:

- Gamma detection interlocking with shield doors
- Personnel shielded access doors (PSAD) interlocked with shielded hatches/doors

This control will ensure the facility worker can not be exposed to high radiation sources.

The TSR operability requirements for mechanical interlocks include the following elements:

- PSAD interlock with the shielded hatches/doors shall be operable.
- The gamma detection instrumentation shall be operable.
- The position instrumentation on the hatch shall be operable.
- The door actuation equipment for the hatch shall be operable, to prevent the hatch from opening when a gamma source is present.
- The gamma door interlocks shall be operable.

If the mechanical interlocks fail, facility workers could be exposed to unacceptable levels of radiation. The above controls actively prevent the shield doors/hatches from opening when facility workers are in the vicinity.

Surveillances related to this LCO include the following elements:

- Periodic functional tests of the PSAD shield door interlock
- Periodic verification that the shield door actuation equipment are operable
- Periodic source checks of the gamma detection instrumentation
- Periodic functional tests of the gamma detector hatch interlock
- Periodic verification that the hatch door actuation equipment are operable

These controls apply to the HLW facility in the operation and standby modes.

Derivation Criteria: This control was selected to prevent unacceptable radiological exposures to the facility worker.

5.5.9 Limiting Conditions for Operation – Process Interlocks Operability

Purpose: This control, based on sections 3.4.1.1, 3.4.1.4, and 3.4.1.8 (Overflow, Molten Glass Spill, and Offgas Release), ensures the process interlocks' operability. This control encompasses three interlocks.

- The high-high canister level interlock stops air to the melter air lift on high-high level.
- The melter feed interlock on high pressure that stops melter feed when the plenum vacuum is lost.
- The high-high vessel level interlock that trips feed to the SBS vessels, the SBS condensate receiver vessel, and the acidic waste vessels on high-high level (high-high level on the SBS and SBS condensate receiver vessels also trips feed to the melter).

If these controls fail, the facility worker could be exposed above radiation and/or chemical exposure standards.

The process interlock TSR operability requirements include the following elements.

High-High Canister Level Interlock

- The canister level monitoring instrumentation shall be operable.
- The interlock from the high-high level setpoint to the melter air lift (including the air safety shutoff valve) shall be operable.
- The interlocks shall be supplied with HLW SDC UPS power.

Melter Feed Interlock on High Pressure

- The melter plenum pressure detection instrumentation shall be operable.
- The melter plenum pressure interlock to stop feed to the melter shall be operable (including isolation valving).
- The interlocks shall have HLW SDC UPS power.

High-High Vessel Level Interlock

- The high-high vessel level instrumentation in the SBS vessels, SBS condensate receiver vessel, ~~and~~ acidic waste vessel, melter feed preparation vessels, melter feed vessels, concentrate receipt vessels, and plant wash and drains vessel shall be operable.
- The high-high vessel level interlocks to trip feed to the SBS vessels, SBS condensate receiver vessel, ~~and acidic waste vessel,~~ and to trip feed to the melter for the SBS and SBS condensate receiver vessels (including isolation valves) shall be operable.

- The high-high vessel level interlocks to trip feed to or from the acidic waste vessel, melter feed preparation vessels, melter feed vessels, concentrate receipt vessels, and plant wash and drains vessel shall be operable.
- The interlocks shall have HLW SDC UPS power.

Surveillances related to this LCO include the following elements for each interlock:

- Periodic functional tests of the level or pressure interlock (including appropriate valve operability)
- Periodic instrument loop calibrations of the level or pressure monitoring instrumentation
- Periodic verification that the level or pressure detection instruments are operable

Operability requirements and surveillances on the HLW SDC UPS power are required, and are covered in a separate LCO.

These controls apply to the HLW facility in operations and standby modes.

Derivation Criteria. This control was selected to prevent unacceptable radiological and chemical exposures to facility workers.

5.5.10 Limiting Conditions for Operation – Bogie Interlocks Operability

Purpose. This control, based on sections 3.4.1.5, and 3.4.1.6 (Canister Drop and Waste Drum Drop Accidents), ensures operability of the bogie interlocks.

This control encompasses two interlocks.

- The drum transfer bogie elevating table interlock (between the drum transfer bogie elevating table and the bogie brakes/motor) prevents the bogie from moving while the elevating table is raised. This prevents the drum from toppling.
- The cask handling bogie gamma interlock prevents the canister cask handling bogie from proceeding from the cask lidding station toward the cask handling tunnel import/export hatch if a high gamma source is in the tunnel. This interlock works in conjunction with the hatch interlocks (section 5.5.8).

A failure of these controls results in exposures to the facility worker above the RES.

The bogie interlock TSR operability requirements include the following elements:

<u>The Drum Transfer Bogie Elevating Table Interlock</u>

- The positional sensors (and associated signal) on the elevating table shall be operable.
- The interlock to the bogie motor/brakes shall be operable.
- The bogie motor/brakes shall be operable.

<u>The Cask Handling/Transfer Bogie Gamma Interlocks</u>

- The Building/Annex walls (interior and exterior) and roof are designated SC-II to provide adequate anchorage of ITS systems.
- The HLW melter handling system containment door and personnel access doors are designated SC-I as part of the C5 confinement boundary.
- Other shield hatches, windows, and shielding/confinement doors are designated SC-II to ensure confinement of radioactive materials during normal conditions and to ensure that impacts with loaded cranes and bogies do not result in unacceptable shine paths.
- Penetrations into R5/C5 confinement boundaries from C2/C3 areas are designated SC-II since their failure could prevent the R5/C5 confinement boundaries from performing their safety function.

5.6.2 Hydrogen-Producing Process Vessels and Associated Piping

Design features for the hydrogen-producing process vessels (concentrate receipt vessels, melter feed preparation vessel, melter feed vessel, and plant wash and drains vessel) and their associated process piping include the following:

- The process vessels and piping will provide primary containment of process fluids (to prevent releases above exposure standards and to support hydrogen purge and mixing).
- The overflow lines will be adequate to prevent pressurization of the vessels and provide a flow path to a collection system, provide protection of the headspace and assumptions regarding the times to the LFL, and provide a hydrogen release path during normal and accident conditions.
- The vessels will be designed for their design life, considering the high-radiation environment and the corrosive and erosive nature of the process streams.

5.6.3 Non-Hydrogen-Producing Process Vessels and Associated Piping

Vessels that do not pose a significant hydrogen hazard are the acidic waste storage vessel, the ammonia tanks, the wet electrostatic precipitator (WESP), the high efficiency mist eliminator (HEME), and the submerged bed scrubber (SBS). Design features for these non-hydrogen producing vessels in the vitrification offgas and liquid waste effluent systems and their associated piping are listed below.

- The process vessels and piping will provide primary containment of process fluids (to prevent releases above exposure standards).
- The vessels will be designed for their design life, considering the environment and the corrosive and erosive nature of the process streams.
- The drain lines from the WESP, the HEME, and the SBS provide a path to the SBS condensate receipt vessel, and the overflow lines from the acidic waste storage vessel provides a path to the plant wash and drains vessel which overflows to a sump.

5.6.4 Ventilation System Exhaust Ductwork and HEPA Filters

Design features for the C5 ventilation system exhaust ductwork include the following:

- The C5 ventilation system exhaust ductwork will provide a passive confinement boundary during normal, abnormal, and accident conditions.

Table 5-1 Hazard and Accident Analysis and Technical Safety Requirement Cross Reference

Chapter 3 Section	Technical Safety Requirement	Control Basis
Hazard Identification Results 3.3.2	AC, Source Inventory Receipt Acceptance Program 5.5.13.1	The need for a source inventory receipt acceptance program is derived from a key assumption of the hazard and accident analysis relied upon to reduce the radiological risks of the facility to acceptable levels.
Liquid Spills, Vessel Failures 3.4.1.1.1	LCO, C5 Ventilation Exhaust System Operability 5.5.1	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, filter releases and direct flow to the exhaust stack. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, Electric Power Operability 5.5.12	This LCO provides controls to support the C5 Ventilation Exhaust System Operability LCO.
	LCO, C3 Area Ventilation Exhaust System Operability 5.5.3	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, and filter releases. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, Process Interlocks Operability 5.5.9	This LCO provides controls to ensure that a canister is not overfilled or allowed to overflow. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
Liquid Spills, Outside the Wet Process Cell 3.4.1.1.2	None (design features only)	
Overflows 3.4.1.2	LCO, ~~High-High Liquid Level Interlock (~~Process Interlocks~~)~~ Operability 5.5.~~7~~9	This LCO provides controls to ensure that the vessels will not overflow. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, C5 Ventilation Exhaust System Operability 5.5.1	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, filter releases and direct flow to the exhaust stack. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.

24590-WTP-SE-ENS-03-161 Rev 0

Attachment 2

Proposed Changes to the Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information (24590-WTP-PSAR-ESH-01-002-04 Rev. 1)

Document Part	Title	Affected Pages
Section 3.4.1.7	HLW Process Vessel Hydrogen Explosions	3.4.1.7-1 and 3.4.1.7-2 (pages provided for information)
Section 4.3	Safety Design Class	4.3-20, 4.3-22, and 4.3-23
Section 4.4	Safety Design Significant	4.4-10 and 4.4-11
Appendix 4A	Tables	4A-3 and 4A-6
Section 5.5	Technical Safety Requirement Derivation	5.5-7, 5.5-8, and 5.5-10
Section 5.6	Design Features	5.6-2
Appendix 5A	Tables	5A-1

3.4.1.7 HLW Process Vessel Hydrogen Explosions

Hydrogen is generated by radiolysis of water and by thermal decomposition of waste products. Flammable gases generated by these mechanisms have the potential of accumulating in the headspace of HLW vessels in concentrations above the lower flammable limit (LFL). Once these gases reach flammable concentrations, a weak ignition source on the order of a few mill-joules can set off a deflagration or detonation in the vapor space.

There are two main source term generation mechanisms associated with an explosion in a process vessel: (1) velocity induced entrainment from the liquid waste surface (called blowdown entrainment) and (2) vaporization from radiative heat transfer.

Bounding explosion source terms were calculated in the severity level calculation using blowdown entrainment and a TNT equivalent model (24590-HLW-Z0C-H01T-00001). Since the deflagration source term calculated using the TNT equivalent method is large compared to the liquid vaporization source, liquid vaporization from radiative heat transfer was not considered in the severity level calculation.

Vessels in the HLW facility have penetrations such as filtered ventilation outlets, filtered inlets, and overflow lines. During a deflagration these penetrations provide a vent path for the expanding combustion gases. The vent area, however, is relatively small and will not prevent or sufficiently reduce a pressure transient.

<u>Design Inputs</u>

Design data used in this analysis are contained in 24590-HLW-Z0C-H01T-00001, *Design Basis Event: HLW Process Vessel Hydrogen Deflagration*. Conservative design and analytical values are contained in the following sections.

<u>Assumptions</u>

The following assumption is identified in 24590-HLW-Z0C-H01T-00001 as being used in the accident analysis. The basis and sensitivity of this assumption is discussed in 24590-HLW-Z0C-H01T-00001.

1 Only wastes with $\geq$ 5 weight percent solids retain hydrogen.

3.4.1.7.1 Hydrogen Explosion Due to Loss of Purge Air

3.4.1.7.1.1 Accident Scenario

<u>Scenario Description</u>

Loss of offsite power causes loss of vessel ventilation and loss of purge air, leading to an accumulation of a flammable/detonable hydrogen air mixture in a HLW vessel. Subsequent ignition of the gas results in the generation of an aerosol cloud that vents along with combustion gases through the PVVS, hydrogen dilution inlet, and the vessel overflow line. Pressurized gases (air, hydrogen, and water vapor) in the vessel vent into the wet process cell via the plant wash and drains vessel (PWDV) and the PWDV overflow sump. The source term consists of waste material vaporized by the heat of the explosion and entrained liquid from the waste surface.

There are two variations of the above accident progression depending on the liquid waste level in the vessel. In the first sequence, the liquid waste level is close enough to the overflow line to cause liquid droplets to be entrained by the blowdown of the combustion gases through the vessel overflow line. Blowdown entrainment through the PVVS in HCP-VSL-00001 or HCP-VSL-00002 is not possible because the ventilation outlet is too far from the surface of the waste at the overflow height. The entrainment source term produced in this case is in addition to the waste material vaporized by the heat of the explosion.

In the second sequence the liquid waste level is far enough below the overflow so that contribution from liquid entrainment is negligible and the source term is made up entirely of liquid waste vaporized by radiative heat transfer.

For either sequence, accumulation of hydrogen to flammable levels in the vapor space of the vessel is precluded by design. The purge air supply line to the vessels is instrumented to detect loss of normal purge air flow and valve in the ITS backup purge air supply. This is sized to maintain the hydrogen concentration in the vapor space at 1 v/o (25 % of LFL) or less under worst-case conditions. Crediting ITS controls, a hydrogen burn in a HLW vessel is considered beyond design basis.

Other Represented Events

This event represents all HLW vessels that have the potential to reach or exceed the LFL in less than 3000 hours.

3.4.1.7.1.2 Evaluation of Source Term

A flammable accumulation of hydrogen in the vessel headspace is prevented by design. Therefore, no source term was developed.

3.4.1.7.1.3 Consequence Calculation

Calculations of the unmitigated consequences were summarized in 24590-HLW-Z0C-W14T-00013. Consequences were not developed for the mitigated accident analysis as the accident is prevented by design.

Co-located Worker Exposure

The unmitigated co-located worker dose is 9910 rem (SL-1). Co-located worker consequences were not developed for the mitigated accident analysis as the accident is prevented by design.

Public Receptor Exposure

The unmitigated public receptor dose is 10.4 rem (SL-1). Public receptor consequences were not developed for the mitigated accident analysis as the accident is prevented by design.

Air supply system

To meet the functional requirements in the headspace, air will be supplied for the continuous headspace purge, spare process line purge, and to the air-operated pulse jet mixers and sparge rings for solids mixing. To ensure that the purge and mixing requirements are met, redundant emergency diesel generators and air compressors will be provided in addition to a UPS-backed control system. To ensure sufficient air is supplied for the continuous headspace purge, the sparge rings, and the SDC air-operated pulse jet mixing system, when pressure instrumentation senses low pressure in the SDC air supply system, a signal is sent to the Pretreatment SDC air supply system to attempt to start a backup air compressor.

Headspace purge

To meet the functional requirements in the vessel headspace, a continuous headspace purge is required. The minimum recommended flow rate is 100 times the maximum hydrogen generation rate. The normal exhaust from the headspace purge will flow through the offgas treatment system. A secondary flow path is through the vessel overflow line. The vessel overflow line also provides protection of the headspace and the assumptions regarding the time to the LFL.

Spare process line purge

To meet the functional requirements in the spare process lines (such as, HCP-PC-00075-S12 and HCP-PC-00093-S12), a continuous headspace purge is required.

Solids mixing

To meet the functional requirements in the headspace, waste agitation is required to release trapped hydrogen gases. The mixing systems include the following.

Loss of air to the normal pulse jet mixer air supply or loss of control to the pulse jet mixing system starts an SDC air-operated pulse jet mixer system in the concentrate receipt vessels and the plant wash and drain vessel. At least half of the pulse jets for each vessel will operate for 15 minutes with a periodicity of operating periods equal to or less than the time required for the vessel headspace to reach 4 % by volume hydrogen, without the headspace purge assuming all of the trapped hydrogen is released. The SDC pulse jet mixer system uses an SDC air supply to provide air to the pulse jet mixing system. The SDC pulse jet mixer system includes valves and controllers independent from the normal pulse jet mixing systems. The SDC pulse jet mixing system controllers and valves require SDC power to maintain operation.

Mechanical agitators will normally be operating in the feed preparation vessel and the melter feed vessel. Emergency mechanical agitation will be provided by either the mechanical agitators, transfer recirculation pumps, or air sparge rings.

4.3.8.4 Standards

The hydrogen mitigation purge system will be designed and constructed in accordance with the following.

- The air supply lines and overflow lines will be designed and constructed in accordance with ASME B31.3.

The transfer and recirculating pumps provide redundant mechanical mixing capabilities. The surveillance requirements required to test and verify the transfer and recirculating pumps performance are discussed in section 5.5.4.

The mechanical agitators provide agitation of the waste. The surveillance requirements required to test and verify mechanical agitator performance are discussed in section 5.5.4.

The following requirements are considered design features and are discussed in section 5.6.2.

- The pulse jet mixers and air sparge rings provide waste mixing.
- The air supply lines and isolation and check valve bodies to provide a continuous air supply path.
- The overflow line provides secondary path for air purge.

4.3.9 DELETED~~High-High Liquid Level Control Loop (H_2 mitigation)~~

~~The high-high liquid level interlock is required to maintain the analyzed liquid levels in the concentrate receipt vessels, melter feed preparation vessel, melter feed vessel, and the plant wash and drains vessel to control headspace volumes and the assumptions regarding the times to LFL.~~

~~4.3.9.1 Credited Safety Function~~

~~The safety function of the high-high liquid level interlock is to maintain the level of liquid in the vessels of concern such that:~~

- ~~The assumptions regarding the minimum time to LFL are protected for melter feed and melter feed preparation vessel.~~
- ~~The assumptions on headspace are protected for the concentrate receipt vessels and the plant wash and drains vessel.~~

~~4.3.9.2 System Description~~

~~The high-high liquid level interlock is required to maintain the analyzed liquid levels in the concentrate receipt vessels, feed preparation vessels, melter feed vessels, and the plant wash and drains vessel.. The safety functions provided by the interlocks related to the time to LFL are required to establish system reliability requirements and initiation of hydrogen purge/solids mixing strategies. The high-high liquid level on the concentrate receipt vessels is interlocked to the liquid transfer control systems in the pretreatment facility. The interlock on feed preparation vessels, melter feed vessels, and the plant wash and drains vessel will stop flow into each respective vessel on detection of a high-high liquid level.~~

~~4.3.9.3 Functional Requirements~~

~~The interlocks will perform their intended safety function (maintain vessel liquid levels in the~~ ~~H_2~~ ~~producing vessels of concern). The liquid level interlocks will detect high-high liquid levels in their vessels and initiate source liquid transfer control systems (stop transfers to the vessel). However, transfers out of the HLW facility are still permitted.~~

~~The interlocks will be SC-I and designed to meet SRD Safety Criteria 1.0-5, 3.2-1, 4.1-2, 4.1-3, 4.1-4, 4.3-4, 4.3-5, 4.4-1, 4.4-2, 4.4-3, and 4.4-4. SDC SSCs will meet QL-1 requirements.~~

~~4.3.9.4Standards~~

~~The high-high liquid level loop will be designed and constructed in accordance with the following:~~

- ~~The high-high liquid level interlock will be designed and constructed in accordance with ISA-S84.01, IEEE-338, IEEE-344, IEEE-379, IEEE-384, and IEEE-1023.~~
- ~~The effects of aging on normal and abnormal functioning will be considered in the design and qualification of the ITS electrical equipment in accordance with IEEE-323.~~

~~4.3.9.5System Evaluation~~

~~The high-high liquid level instrument control loop will control high-high liquid levels in the vessel and initiate liquid transfer controls (stop transfers to the vessel) for the plant wash and drains vessel, and stop transfers to other vessels in the facility that have an overflow path to the plant wash and drains vessel. ISA-S84.01 is applied for all automatically executed safety-instrumented systems to provide the necessary guidance to ensure the required reliability of those systems (~5.0 × 10⁻³/yr). A tailored version of IEEE 338 supplements ISA-S84.01 in designing safety-instrumented systems so they can be tested to prove that the adequately perform their required safety functions. A tailored version of IEEE 344 is applied to those safety-instrumented systems required to function during and (or) after a seismic event. A tailored version of IEEE 379 is applied to safety-instrumented systems to supplement ISA-S84.01 in design considerations ensuring that the single failure criterion of those systems is met. A tailored version of IEEE 384 is applied to safety-instrumented systems to supplement ISA-S84.01 in design considerations for independence of multiple-channel safety systems. Finally, a tailored version of IEEE 1023 is applied to all safety functions requiring indication and/or alarm at a safety qualified operator interface.~~

~~4.3.9.6Controls (TSRs)~~

~~Each high-high liquid level control loop will control the volume of the headspace. Therefore, a specific TSR will be developed for each loop specifying surveillance and testing requirements. The interlocks necessary to ensure adequate headspace are discussed in section 5.5.7.~~

4.3.10 Pulse Ventilation Treatment System

The pulse ventilation treatment system contains fans, HEPA filters, electric preheaters, and ducting required to discharge the air emissions from fluidics equipment. It is an integral part of the solids mixing air system (sections 4.3.7 and 4.3.8).

4.3.10.1 Credited Safety Function

The safety function of the pulse ventilation treatment system is to maintain airflow from the pulse jet mixers as part of solids mixing. The ductwork and fans provide a flow path for the fluidics equipment. The HEPA filters will not clog or block the flow path. The HEPA filters are SDS to support normal operations. The preheaters are SDS to help maintain the flow path through the HEPA filters by preventing the filters from becoming saturated with moisture.

High-High Vessel Level Interlock

The acidic waste vessel high-high liquid level interlock prevents overflows of the vessel. The SBS and SBS condensate receiver vessel high-high level interlocks prevents a liquid level that could potentially block the offgas system. The concentrate receipt vessels, the melter feed preparation vessel, the melter feed vessel, and the plant wash and drains vessel high-high liquid level interlocks provide overflow protection~~ (note that these interlocks are SDC due to hydrogen control issues, but perform this SDS function as well)~~.

4.4.4.2 System Description

The interlocks are designed to control or mitigate accident conditions resulting in glass spills, overflows, or failure of the offgas system.

High-High Canister Level Interlock

The level detection for the canister sends a signal to the programmable protection system. When the level detection system for the canister exceeds the high-high level setpoint, the ITS control system shuts off air to the safety valves to stop air to the melter air lift, which stops the pour.

Melter Feed Interlock on High Pressure

The melter feed/plenum pressure interlocks stop feed to the melter and film cooler injection air in the event of loss of melter plenum vacuum or pressurization.

High-High Vessel Level Interlock

SBS and SBS condensate receiver vessel high-high liquid level interlock automatically trips melter feed and SBS solids suspension system recycle.

The acidic waste vessel high-high liquid level interlock automatically trips feed into the acidic waste vessel at the high-high liquid level setpoint.

The melter feed preparation vessels high-high liquid level interlocks automatically trips feed into the affected melter feed preparation vessel at the high-high liquid level setpoint.

The melter feed vessels high-high liquid level interlocks automatically trips feed into the affected melter feed preparation vessel at the high-high liquid level setpoint.

The concentrate receipt vessels high-high liquid level interlocks automatically trips feed into the affected concentrate receipt vessel at the high-high liquid level setpoint. The high-high liquid level on the concentrate receipt vessels are interlocked to the liquid transfer control systems in the pretreatment facility.

The plant wash and drains vessel high-high level interlock automatically trips feed into the plant wash and drains vessel at the high-high liquid level setpoint.

~~The high-high liquid level on the concentrate receipt vessels is interlocked to the liquid transfer control systems in the Pretreatment facility. The interlock on feed preparation vessels, melter feed vessels, and the plant wash and drains vessel will stop flow into each respective vessel on detection of a high-high liquid level.~~

4.4.4.3 Functional Requirements

The interlocks will meet the reliability requirements of 5.0×10^{-3}/yr. In the DBE analysis, the interlocks will be SC-III and designed to meet SRD Safety Criteria 1.0-5, 3.2-1, 4.1-2, 4.1-3, 4.1-4 4.3-4, 4.3-5, 4.4-1, 4.4-2, 4.4-3, and 4.4-5. SDS SSCs will meet QL-2 requirements.

High-High Canister Level Interlock

The canister level measurement instrumentation will be able to detect a high-high level of glass in the canister and provide an actuating signal to the associated interlock that follows. The melter airlift process will stop feed to the melter on receiving an actuation signal from the high-high level signal from the canister level measurement instrumentation.

Melter Feed Interlock on High Pressure

The melter plenum pressure instrumentation will be able to detect rises in pressure in the melter plenum and provide an actuating signal to the associated interlocks that follow when the melter plenum pressure reaches a predetermined value. The melter plenum pressure interlocks will stop feed to the melter and film cooler injection air on receiving an actuation signal from the melter plenum pressure instrumentation.

High-High Vessel Level Interlock

The high-high vessel liquid level instrumentation will be able to detect a high-high level of liquid in the vessels and provide an actuating signal to the transfer pumps or valves that are providing feed. The transfer devices or valves will stop inflows to the destination vessel on receiving an actuation signal from the high-high level instrumentation. For the SBS and SBS condensate receiver vessel, the high-high interlock also shuts down the melter feed.

4.4.4.4 Standards

The following interlocks will be designed and constructed in accordance with ISA S84.01, IEEE 338, and IEEE 1023:

- High-high canister level interlock
- Melter feed interlock on high pressure
- SBS, SBS condensate receiver vessel, ~~and~~ acidic waste vessel, melter feed preparation vessel, melter feed vessel, concentrate receipt vessels, and plant wash and drains vessel high-high level interlock
- The effects of aging on normal and abnormal functioning will be considered in the design and qualification of the ITS electrical equipment in accordance with IEEE 323.

4.4.4.5 System Evaluation

The interlocks will reliably stop process operations until the required safety condition has been met. ISA S84.01 is applied for all automatically executed safety instrumented systems to provide the necessary guidance to ensure the required reliability of those systems. A tailored version of IEEE 338 is applied to supplement ISA S84.01 in designing safety instrumented systems so they can be tested to prove that the

Table 4A-1 Important to Safety: Description and Basis for Safety Design Class Structures, Systems, and Components

SDC System (Major Components)	Safety Function	Functional Requirements/ Standards (Chapter 4)	Basis for ITS Designation (Chapter 3)
Overflow Lines in Concentrate Receipt, Melter Feed Preparation, Melter Feed, and Plant Wash and Drains Vessels	Provide an alternative passive pathway for H_2 ventilation Prevent overpressurization resulting in spills (SDS function) H_2 mitigation - protects assumptions of time to LFL	Section 4.3.8	Section 3.4.1.1, 3.4.1.2, 3.4.1.7, and 3.4.10
~~High-high Liquid Level Detection Interlock in Melter Feed Preparation Vessels and Melter Feed Vessels~~	~~For H_2 mitigation – protects assumptions of time to LFL~~ ~~For overflow protection~~	~~Sections 4.3.9, and 4.4.4~~	~~Section 3.4.1.2~~
~~High-high Liquid Level Detection Interlock in Concentrate Receipt Vessels and Plant Wash and Drains Vessel~~	~~For H_2 mitigation – protects headspace assumptions~~ ~~For overflow protection~~	~~Sections 4.3.9, and 4.4.4~~	~~Section 3.4.1.2~~
Pulse Ventilation Treatment System Exhaust Fans and Safety Controls to Transfer to Standby Fan	The fans provide a flow path for the fluidics equipment	Section 4.3.10	Section 3.4.1.7
Pulse Ventilation Treatment System Ductwork	The ductwork provides a flow path for the fluidics equipment Provides venting to prevent overpressurization resulting in spills	Section 4.3.10	Sections 3.4.1.1, and 3.4.1.7
Gamma Monitors Interlocked with Shield Doors	Prevents entry into a high radiation area	Section 4.3.11	Table 3A-24
Shield Door Interlocks and Positional Switches	Prevents multiple shield barriers from opening at once	Section 4.3.11	Table 3A-24
Gamma Monitors Interlocked with Posting Boxes	Prevents operator exposure due to high radiation	Section 4.3.11	Table 3A-24

Table 4A-2 Important to Safety: Description and Basis for Safety Design Significant Structures, Systems, and Components

SDS System (Major components)	Safety Function	Functional Requirements/ Standards (Chapter 4)	Basis for ITS Designation (Chapter 3)
High-High Liquid Level Detection Interlock in Acidic Waste Vessel, Melter Feed Preparation Vessel, Melter Feed Vessel, Concentrate Receipt Vessels, and Plant Wash and Drains Vessel	For overflow protection	Section 4.4.4	Section 3.4.1.2
High-High Liquid Level Detection Interlock in SBS and SBS Condensate Receiver Vessel	To prevent blockage of the offgas system (H_2 mitigation)	Section 4.4.4	Section 3.4.1.8
Radiation Monitor in Cooling Water Loop	Detect radiation in non-active process lines and signal interlock	Section 4.4.5	Table 3A-24
Interlock with Radiation Monitoring in Cooling Water Loop Isolation Valves.	On detection of radiation, automatically stop flow and engage isolation valves	Section 4.4.5	Table 3A-24
Acidic Waste, SBS, SBS Condensate Vessels	Provide primary confinement of liquids	Section 4.4.6	Section 3.4.1.1, 3.4.1.3, and 3.4.2.1
Process Piping	Provide primary confinement of liquids	Section 4.4.7	Sections 3.4.1.1, 3.4.1.3, 3.4.1.12, and 3.4.2.1
Minimum barometric head of 34 ft associated with service lines into active vessels (e.g. jet pump piping)	Provide sufficient barometric head to prevent blowback or suckback of contamination to potentially occupied areas	Section 4.4.7	Table 3A-24
Melter Shell	Shell provides containment of bulk glass	Section 4.4.8	Sections 3.4.1.4 and 3.4.2.1

5.5.6 Limiting Conditions for Operation – Process Vessel Cooling Water Monitoring and Isolation Operability

Purpose: This control, based on facility worker protection, ensures the operability of the process vessel cooling water monitoring and isolation system. This ensures that contaminated cooling water is detected and isolated. Without controls, contaminated cooling water could cause exposures to the facility worker above the RES. This control will ensure the facility worker cannot be exposed to radiation from contaminated cooling water.

The process cooling water is circulated to the HLW plant equipment via a closed loop distribution system. When high radiation is detected in the process cooling water, the process vessel cooling water monitoring and isolation system automatically isolates the return header, and stops the process cooling water pumps.

The TSR operability requirements for the process vessel cooling water monitoring and isolation system include the following elements:

- Process cooling water shall be continuously monitored for radiation.
- Process vessel cooling water monitoring and isolation system interlocks (including isolation valves) shall be operable.

If the process cooling water system isolation controls fail, facility workers could be exposed to an unacceptable level of radiation. The above controls confine the radioactive contaminated process water.

Surveillances related to this LCO include the following elements:

- Periodic source checks of the radiation monitoring equipment
- Periodic functional tests of the process vessel cooling water monitoring and isolation system interlocks, including isolation valve functionality

These controls apply to the HLW facility in all modes.

Derivation Criteria: This control was selected to prevent unacceptable radiological exposures to facility workers.

5.5.7 DELETED~~Limiting Conditions for Operation – High-High Liquid Level Interlock (Process Interlocks) Operability~~

~~**Purpose:** This control, based on section 3.4.1.7, HLW Process Vessel Hydrogen Explosions, ensures the operability of the high-high liquid level interlocks. The interlocks protect high liquid levels and loss of headspace volume in the following vessels:~~

~~- Concentrate feed (two vessels) – interlock is required to provide overflow protection and to protect headspace assumptions for the associated vessel.~~

~~- Melter feed (two vessels) – interlock is required to provide overflow protection and to protect assumptions regarding time to LFL for the associated vessel.~~

- ~~Melter feed preparation (two vessels) – interlock is required to provide overflow protection and to protect assumptions regarding time to LFL for the associated vessel.~~
- ~~Plant wash and drains – interlock is required to provide overflow protection and to protect headspace assumptions.~~

~~This control maintains adequate headspace in the vessels to maintain a purge flow and to prevent reaching LFL. When the melter feed preparation and melter feed vessels reach the high-high level, an interlock with the source liquid transfer control system terminates transfers into the vessels. When the two concentrate feed vessels and the plant wash and drains vessels reach the high-high level, an interlock stops flow into the vessels from all sending systems. Without controls, loss of headspace volumes will reduce the time to reach LFL in the vessel headspaces. This could challenge the assumptions in the accident analysis with respect to system reliability (reestablishing the purge system) and the hydrogen purge/solids mixing strategies. This control will ensure that time to restore headspace purge is maintained.~~

~~The TSR operability requirements for the high-high liquid level interlock include the following elements.~~

- ~~The level detection instrumentation in the two concentrate feed vessels, the two melter feed vessels, the two melter feed preparation vessels, and the plant wash and drains vessel shall be operable.~~
- ~~All in-feed shutdown valves shall be operable (specific valves will be identified during detailed design).~~
- ~~The high-high level detection interlocks in the two concentrate feed vessels, the two melter feed vessels, the two melter feed preparation vessels, and the plant wash and drains vessel (including necessary shutoff valves) shall be operable.~~
- ~~The high-high level detection interlocks shall be provided with HLW SDC UPS.~~

~~If these controls fail, the levels in the vessels could go above those analyzed in the accident analysis. An increase in level reduces the time to reach the LFL in the vessels, thus reducing the time allowed to restore purge flow in the vessel. Purge flow is required to prevent a hydrogen deflagration/detonation.~~

~~Surveillances related to this LCO include the following elements:~~

- ~~Periodic functional tests of the high-high level interlock for each vessel (including necessary shutoff valves)~~
- ~~Periodic instrument loop calibrations of the high-high level monitoring instrumentation~~
- ~~Periodic verification that the level detection instruments are operable~~

~~Operability requirements and surveillances on the HLW SDC UPS power are required, and are covered in a separate LCO.~~

~~These controls apply to the HLW facility in all modes.~~

~~**Derivation Criteria:** This control was selected to prevent hydrogen explosions/deflagrations within the affected vessel(s).~~

- The melter feed interlock on high pressure that stops melter feed and film cooler injection air when the plenum vacuum is lost.
- The high-high vessel level interlock for the SBS vessels and SBS condensate receiver vessels trips the feed to the melters. The high-high vessel level interlocks for the acidic waste vessel trips the feed from the SBS vessels and SBS condensate receiver vessels.

If these controls fail, the facility worker could be exposed above radiation and/or chemical exposure standards.

The process interlock TSR operability requirements include the following elements.

High-High Canister Level Interlock

- The canister level monitoring instrumentation shall be operable.
- The interlock from the high-high level setpoint to the melter air lift (including the air safety shutoff valve) shall be operable.
- The interlocks shall be supplied with HLW SDC UPS power.

Melter Feed Interlock on High Pressure

- Melter plenum pressure detection instrumentation shall be operable.
- Melter plenum pressure interlock to stop feed to the melter and film cooler injection air shall be operable (including isolation valving).
- The interlocks shall have HLW SDC UPS power.

High-High Vessel Level Interlock

- The high-high vessel level instrumentation in the SBS vessels, SBS condensate receiver vessels, and acidic waste vessel, melter feed preparation vessels, melter feed vessels, concentrate receipt vessels, and plant wash and drains vessel shall be operable.
- The high-high vessel level interlocks to trip feed to or from the SBS vessels, SBS condensate receiver vessels, ~~and acidic waste vessel,~~ and to trip feed to the melters for the SBS and SBS condensate receiver vessels (including isolation valves) shall be operable.
- The high-high vessel level interlocks to trip feed to or from the acidic waste vessel, melter feed preparation vessels, melter feed vessels, concentrate receipt vessels, and plant wash and drains vessel shall be operable.
- The interlocks shall have HLW SDC UPS power.

Surveillances related to this LCO include the following elements for each interlock:

- Periodic functional tests of the level or pressure interlock (including appropriate valve operability)
- Periodic instrument loop calibrations of the level or pressure monitoring instrumentation
- Periodic verification that the level or pressure detection instruments are operable

- The design of the structure will incorporate joggled paths for through-wall penetrations, minimizing radiation streaming. These SSCs will be seismically qualified, as appropriate, to prevent a catastrophic loss of shielding.
- The facility must be designed and constructed to preclude differential movement between structures and service connections or unacceptable settlement that could break or damage the connections and lead to a liquid spill of HLW concentrate.
- The minimum opening between the pour tunnel and melter cave shall be 5.3 ft^2.

5.6.2 Hydrogen-Producing Process Vessels and Associated Piping

Design features for the hydrogen-producing process vessels (concentrate receipt vessels, melter feed preparation vessels, melter feed vessels, and plant wash and drains vessel) and their associated process piping include the following:

- The process vessels and piping will provide primary containment of process fluids (to prevent releases above exposure standards and to support hydrogen purge and mixing).
- The overflow lines will be adequate to prevent pressurization of the vessels and provide a flow path to a collection system, provide protection of the headspace and assumptions regarding the times to the LFL, and provide a hydrogen release path during normal and accident conditions.
- The vessels will be designed for their design life, considering the high-radiation environment and the corrosive and erosive nature of the process streams.
- The secondary piping of the concentrate receipt vessel coaxial containment piping will be sloped and routed to the wet process cell.

5.6.3 Non-Hydrogen-Producing Process Vessels and Associated Piping

Vessels that do not pose a significant hydrogen hazard are the acidic waste vessel, the ammonia tanks, the wet electrostatic precipitators (WESPs), the HEMEs, and the submerged bed scrubbers (SBSs). Design features for these non-hydrogen producing vessels in the vitrification offgas and liquid waste effluent systems and their associated piping are listed below.

- The process vessels and piping will provide primary containment of process fluids (to prevent releases above exposure standards).
- The vessels will be designed for their design life, considering the environment and the corrosive and erosive nature of the process streams.
- The drain lines from the WESP, the HEME, and the SBS provide a path to the SBS condensate receipt vessel, and the overflow lines from the acidic waste vessel provide a path to the plant wash and drains vessel that overflows to a sump.

5.6.4 Ventilation System Exhaust Ductwork and HEPA Filters

Design features for the C5 ventilation system exhaust ductwork include the following:

- The C5 ventilation system exhaust ductwork will provide a passive confinement boundary during normal, abnormal, and accident conditions.

Table 5A-1 Hazard and Accident Analysis and Technical Safety Requirement Cross Reference

Chapter 3 Section	Technical Safety Requirement	Control Basis
Hazard Identification Results 3.3.2	AC, Source Inventory Receipt Acceptance Program 5.5.13.1	The need for a source inventory receipt acceptance program is derived from a key assumption of the hazard and accident analysis relied upon to reduce the radiological risks of the facility to acceptable levels.
Liquid Spill due to Failure of HLW Concentrate Receipt Vessel 3.4.1.1.1	LCO, C5 Ventilation Exhaust System Operability 5.5.1	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, filter releases, and direct flow to the exhaust stack. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, Electric Power Operability 5.5.12	This LCO provides controls to support the C5 Ventilation Exhaust System Operability LCO.
Liquid Spills, Outside the Wet Process Cell 3.4.1.1.2	LCO, C5 Ventilation Exhaust System Operability 5.5.1	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, filter releases, and direct flow to the exhaust stack. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, Electric Power Operability 5.5.12	This LCO provides controls to support the C5 Ventilation Exhaust System Operability LCO.
Overflow from HLW Concentrate Receipt Vessel due to Failure of Level Control in the Vessel 3.4.1.2.1	LCO, ~~High-High Liquid Level Interlock (~~Process Interlocks~~)~~ Operability 5.5.~~7~~9	This LCO provides controls to ensure that the vessels will not overflow. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, C5 Ventilation Exhaust System Operability 5.5.1	This LCO provides controls to confine aerosolized materials, maintain cascade airflow, filter releases and direct flow to the exhaust stack. This control is necessary to lessen the likelihood of facility worker exposures and to lessen the consequences of the co-located worker and the public exposures.
	LCO, Electric Power Operability 5.5.12	This LCO provides controls to support the C5 Ventilation Exhaust System Operability LCO and the High-High Liquid Level Interlock (Process Interlocks) Operability LCO.
	AC, Procedures 5.5.13.9	This AC ensures that heightened attention is given to those procedural aspects that are control strategy elements specifically credited to meet exposure standards.

24590-WTP-SE-ENS-03-161 Rev 0

Attachment 3

CCN 059856

Document Number	Title
059856	Effects of resizing the High Level Waste Feed Preparation Vessel HFP-VSL-00001 and the High Level Waste Feed Vessel HFP-VSL-00002

# of pages (including cover sheet): 6

24590-WTP-SE-ENS-03-161 Rev.0

RPP WTP

Memorandum

To: Richard Garrett | Date: June 17, 2003

From: Rick J. Van Vleet | CCN: 059856

Ext: 371-3753

Fax: 371-3505

Subject: Effects of resizing the High Level Waste Feed Preparation Vessel HFP-VSL-00001 and the High Level Waste Feed Vessel HFP-VSL-00002

References:
1) 24590-HLW-Z0C-W14T-00013, Rev. A, *Revised Severity Level Calculations for the HLW Facility.*
2) 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information.*
3) 24590-HLW-M6C-HFP-00001, Rev. C, *HFP-VSL-00001 and HFP-VSL-00002 Vessel Sizing Calculation.*

This assessment examines the severity level analysis in 24590-HLW-Z0C-W14T-00013, *Revised Severity Level Calculations for the HLW Facility* (Reference 1). The results of Reference 1 were used to select the design basis events analyzed and presented in 24590-WTP-PSAR-ESH-01-002-04, *Preliminary Safety Analysis Report to Support Construction Authorization; HLW Facility Specific Information* (Reference 2). As a result of a sizing calculation revision (Reference 3) the vessel volumes have changed. The purpose of this assessment is to examine the effect on the severity levels calculated for these vessels and the times to the lower flammability limit. Then a determination on the effect on the design basis event analysis conclusions (Reference 2) can be assessed.

Basis for comparison

This assessment examines only the effect on the analyses, as presented in Reference 1. That is, all conditions and assumptions providing the basis for Reference 1 are assumed to hold. The only difference is the volume change.

059856

Changes

Table 1 presents the original volumes from Reference 1 and the re-sized volumes.

Table 1. Vessel HFP-VSL-00001/2 (V31101/2) Volumes

Level	Original Volume (gal)[1]	Re-sized Volume (gal)[2]
Total	8,765	8,384
Maximum Operating Volume (overflow)	8,480	7,722
High-High	8,069	7,722
High	7,626	7,722
Upper Operating Level	7,186	7,282
Headspace[3]	1,579	1,102

[1]Values from the Plant Item List Database
[2]Values from 24590-HLW-M6C-HFP-00001, Rev. C, pages 12-16
[3]The headspace in Reference 1 used for the hydrogen explosion is the total volume minus the upper operating level volume.

Effect on Severity Level analyses

Four areas are affected in Reference 2.

- Vessel spills
- Vessel sprays
- Times to lower flammability limit
- Vessel explosions

Vessel Spills

For vessel spills, the liquid level in the vessel is assumed to be at maximum operating level when the vessel experiences a catastrophic failure. The source term for this accident is comprised of a free fall portion and an entrainment portion. Decreasing the volume of the vessel leads to a smaller source term. This change is evaluated below.

Vessel Sprays

For vessel sprays, a pinhole develops and lets spray continue for the duration of the exposure. A differential pressure of 50 psi is used to bound the hydrostatic head in any high-level waste vessel. The pinhole does not plug or enlarge during the duration of the spray. Changing the vessel volume does not have an effect on this accident. The source term is determined by the flow through the pinhole for either 8 hours (facility worker or co-located worker) or 24 hours (public). Since the amount of material that can exit the pinhole is much smaller than the volume of the vessel, a slight decrease in the vessel volume has no impact.

059856

Times to Lower Flammability Limit

The times to lower flammability limit is calculated assuming the vessel is filled to the overflow and that no ventilation (active or passive) occurs. The initial concentration in the headspace is taken as 1 % hydrogen. One hundred percent of the generated gas is released to the headspace. The generation rate is dependent on the volume of waste. In addition, the volume of the headspace is needed to calculate the times. Both these values change in the re-sizing of the vessel.

Vessel Explosions

For explosions, the headspace volume is at a given hydrogen concentration. The original analysis presented results for explosions at upper operating level ("normal" operating level) and ten different hydrogen concentrations. For simplicity, only the highest hydrogen concentration (30 %) is examined. Changing the volume of the vessel affects the volume of the headspace. A smaller headspace results in an decreased source term and hence lower consequences. These are evaluated below.

Vessel HFP-VSL-00001 is evaluated using waste stream HCP01 *HLW Concentrate* (HV107). Vessel HFP-VSL-00002 is evaluated using waste stream HFP03 *Blended HLW Melter Feed with Sugar* (HV104). For vessel spills, vessel sprays, and explosions, the unit doses is from Envelope A/D (Reference 1). For calculating times to the lower flammability limit, Envelope B/D is used (Reference 1).

Table 2 shows the changes to the time to lower flammability limit for the re-sized vessel.

Table 2. Time to Lower Flammability Limit

Vessel	Quantity	Old Vessel	Re-sized Vessel
HFP-VSL-00001	Time (h) to 1 % in headspace	0.8	2.0
	Time to (h) 4 % in headspace	3.1	7.9
	Δt ($t_{4\,\%}$ - $t_{1\,\%}$)*	2.3	6.0
HFP-VSL-00002	Time (h) to 1 % in headspace	0.9	2.3
	Time to (h) 4 % in headspace	3.6	9.2
	Δt ($t_{4\,\%}$ - $t_{1\,\%}$)*	2.7	7.0

*Headspace is initially at 1 % hydrogen.

The vessel re-sizing greatly affected the time to lower flammability limit.

Tables 3 and 4 present the original dose consequences and severity levels and results for the re-sized vessels.

059856

Table 3. Dose Consequences and Severity Levels for HFP-VSL-00001

Accident Type	Receptor	Original Vessel		Re-sized Vessel	
		CEDE (rem)	SL	CEDE (rem)	SL
Vessel Spill	P	3.00E-01	SL-3	2.74E-01	SL-3
	CW	4.16E+02	SL-1	3.79E+02	SL-1
	FW	5.03E+03	SL-1	5.03E+03	SL-1
Vessel Spray	P	7.10E-02	SL-4	7.10E-02	SL-4
	CW	1.69E+01	SL-2	1.69E+01	SL-2
	FW	5.03E+03	SL-1	5.03E+03	SL-1
Explosion	P	7.42E-03	SL-3	5.18E-03	SL-3
	CW	1.70E+01	SL-1	1.19E+01	SL-1
	FW	5.03E+01	SL-1	5.03E+01	SL-1

SL means Severity Level
P means Public Receptor
CW means Co-located Worker
FW means Facility Worker

Table 4. Dose Consequences and Severity Levels for HFP-VSL-00002

Accident Type	Receptor	Original Vessel		Re-sized Vessel	
		CEDE (rem)	SL	CEDE (rem)	SL
Vessel Spill	P	2.87E-01	SL-3	2.61E-01	SL-3
	CW	3.97E+02	SL-1	3.62E+02	SL-1
	FW	4.62E+03	SL-1	4.62E+03	SL-1
Vessel Spray	P	6.65E-02	SL-4	6.65E-02	SL-4
	CW	1.58E+01	SL-2	1.58E+01	SL-2
	FW	4.62E+03	SL-1	4.62E+03	SL-1
Explosion	P	6.81E-03	SL-3	4.76E-03	SL-3
	CW	1.56E+01	SL-1	1.09E+01	SL-1
	FW	4.62E+01	SL-1	4.62E+01	SL-1

SL means Severity Level
P means Public Receptor
CW means Co-located Worker
FW means Facility Worker

Note, the facility worker doses stay the same since they are based on exposure to 100 mg/m^3 aerosol concentration for 1 hour.

As can be seen in Table 3, using the same modeling assumptions and mass balance as used in 24590-HLW-Z0C-W14T-00013, Rev. A, the re-sized vessel results in decreased dose consequences for vessel spills and explosions while vessel sprays remain unchanged. It should be noted that the severity level determinations remain the same as previously documented (Reference 1).

059856

Conclusion

The re-sizing of vessels HFP-VSL-00001 and HFP-VSL-00002 does not change the documented (Reference 1) severity level determinations. The hydrogen generation rates decreased (due to a smaller volume of waste) and this affects the purge requirements. However, the overall hydrogen strategy has not changed. This means that there is no impact to the design basis event selection document or to any control strategies.

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Environmental and Nuclear Safety

Review and concurrence: Jay Lavender

RJVV/rjvv

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24590-WTP-SE-ENS-03-161 Rev 0

Attachment 4

Crosswalk of Affected Sections from Revision 0c to Revision 1 of the HLW PSAR (24590-WTP-PSAR-ESH-01-002-04)

of pages (including cover sheet): 2

Crosswalk of Affected Sections from Revision 0c to Revision 1 of the HLW PSAR (24590-WTP-PSAR-ESH-01-002-04)

Affected Revision 0c Sections	Affected Revision 1 Sections
3.4.1.7	No changes
3.4.1.7.2.2	No changes
4.3.8.3	4.3.8.3
4.3.9	4.3.9
4.4.4.1	4.4.4.1
4.4.4.2	4.4.4.2
4.4.4.4	4.4.4.4
Table 4-1	Table 4A-1
Table 4-2	Table 4A-2
5.5.7	5.5.7
5.5.9	5.5.9
5.6.2	5.6.2
Table 5-1	Table 5A-1